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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application. In comparison to the prior version of claims, claims 9, 17, 24 and 26 are currently amended, claims 18 and 25 are canceled and claims 1-8, 10-16, 19-23, 27 and 28 remain as original. Claims 29-32 are new.

1. (Original) A control system for controlling movement of a DC motor, comprising:

a movement detector to detect movement of a DC motor and output a corresponding feedback signal;

a digital phase detector to compare phase of the feedback signal from said movement detector with phase of a reference signal and output a comparison signal, wherein the digital phase detector follows a describing function to model non-linear components of the reference signal; and

a digital loop filter to filter noise from the comparison signal for control of the DC motor.

2. (Original) The control system according to claim 1, wherein said movement detector further comprises:

a carriage which is attached to the motor with a belt drive, said carriage moving in response to movement of the motor; and

a linear optical encoder attached to said carriage and moving therewith, wherein said linear optical encoder outputs the feedback signal in response to movement of the motor.

3. (Original) The control system according to claim 1, wherein said digital phase detector and said digital loop filter are disposed within an application specific integrated circuit.

4. (Original) The control system according to claim 1, wherein said digital phase detector is a phase frequency detector.

5. (Original) The control system according to claim 4, said phase frequency detector comprising:

a state machine to receive the feedback signal and the reference signal and selectively output a corresponding signal of UP, DOWN, or no signal;

a first current source to output positive current as the comparison signal in response to the UP signal; and

a second current source to output negative current as the comparison signal in response to the DOWN signal,

wherein the comparison signal is a high impedance state of neither positive nor negative current when said state machine selects to output no signal.

6. (Original) The control system according to claim 5, wherein said state machine tracks a time varying reference signal and selectively outputs the signal of UP, DOWN, or no signal in response to the tracked time varying reference signal.

7. (Original) The control system according to claim 6, wherein said state machine is weighted with states to provide for system damping, such that the amount of time that said digital loop filter changes during comparison by said digital phase detector is minimized.

8. (Original) The control system according to claim 4, wherein said phase frequency detector has a memory to track a time varying reference signal and selectively control the comparison signal in response to the time varying reference signal.

9. (Currently Amended) The control system according to claim 8, wherein said ~~digital phase detector has a~~ memory has ~~with~~ weighted states to provide for system damping, such that the amount of time that said digital loop filter changes during comparison by said digital phase detector is minimized.

10. (Original) The control system according to claim 1, wherein said digital phase detector is a phase frequency detector and said digital filter is a digital compensator, wherein said digital compensator has a time varying sample interval which is set by a digital clock.

11. (Original) A control system for controlling movement of a DC motor, comprising:

a movement detector to detect movement of a DC motor including:

a carriage which is attached to the motor with a belt drive, said carriage moving in response to movement of the motor; and

an encoder attached to said carnage and moving therewith, wherein the encoder outputs a feedback signal in response to movement of the motor; and

an application specific integrated circuit including:

a digital phase detector to compare phase of the feedback signal from the encoder with phase of a reference signal and output a comparison signal, wherein the digital phase detector models non-linear components of the reference signal; and

a digital loop filter to filter noise from the comparison signal for control of the DC motor.

12. (Original) The control system according to claim 11, wherein said digital phase detector is a phase frequency detector.

13. (Original) The control system according to claim 12, wherein said phase frequency detector selectively outputs positive current, negative current, or no current as the comparison signal in response to the reference signal and the feedback signal.

14. (Original) The control system according to claim 12, wherein said phase frequency detector tracks a time varying reference signal and selects the comparison signal in response to the tracked time varying reference signal.

15. (Original) The control system according to claim 12, wherein said phase frequency detector provides for system damping, such that the amount of time that said digital loop filter changes during comparison by said digital phase detector is minimized.

16. (Original) The control system according to claim 12, wherein said phase frequency detector has a memory to track a time varying reference signal and selectively control the comparison signal in response to the time varying reference signal.

17. (Currently Amended) A control system for controlling velocity of an inkjet print head in response to a reference signal, comprising:

a velocity detector to detect velocity of an inkjet print head and output a corresponding feedback signal;

a digital phase frequency detector to compare phase of the feedback signal from said velocity detector with the reference signal and output a corresponding comparison signal, wherein said digital phase frequency detector follows a describing function;

a digital loop filter to filter noise from the comparison signal; and

a motor to control velocity of the inkjet print head in response to the filtered

comparison signal.

18. (Canceled).

19. (Original) The control system according to claim 17, wherein said digital phase frequency detector and said digital loop filter are disposed within an application specific integrated circuit.

20. (Original) The control system according to claim 17, wherein said phase frequency detector selectively outputs positive current, negative current, or no current as the comparison signal in response to the reference signal and the feedback signal.

21. (Original) The control system according to claim 17, wherein said phase frequency detector tracks a time varying reference signal and selects the comparison signal in response to the tracked time varying reference signal.

22. (Original) The control system according to claim 17, wherein said phase frequency detector provides system damping by anticipating a step response of said motor, such that the amount of time that said digital loop filter changes during comparison by said digital phase detector is minimized.

23. (Original) The control system according to claim 17, wherein said phase frequency detector has a memory to track a time varying reference signal and selectively controls the comparison signal in response to the time varying reference signal.

24. (Currently Amended) A method for controlling velocity of an inkjet print head in response to a reference signal, comprising the steps of:

detecting a velocity of an inkjet print head and outputting a corresponding feedback signal;

comparing phase of the feedback signal with phase of the reference signal using a digital phase frequency detector and outputting a corresponding comparison signal, said comparing step following a describing function;

filtering noise from the comparison signal; and

controlling velocity of the inkjet print head in response to the filtered comparison signal.

25. (Canceled).

26. (Currently Amended) The method according to claim 24, wherein said detecting step tracks a time varying reference signal and selects a the corresponding comparison signal in response to the tracked time varying reference signal.

27. (Original) The method according to claim 24, wherein said detecting step provides damping by anticipating a step response of the inkjet print head, such that the amount of time required by said comparing step is minimized.

28. (Original) A control system for controlling velocity of an inkjet print head in a system including a velocity detector to detect inkjet print head velocity and output a corresponding feedback signal, a phase detector to compare phase of the feedback signal with phase of a reference signal and output a corresponding comparison signal, a digital loop filter to filter noise from the comparison signal, and a motor to control velocity of the inkjet print head in response to the filtered comparison signal, said control system produced by operations, comprising:

modeling the phase detector in a closed loop, phase locked loop configuration with a describing function; and

dampening the frequency response of the describing function by anticipating a step response of the motor during initial movement.

29. (New) A control system for controlling velocity of an inkjet print head in response to a reference signal, comprising:

a velocity detector to detect velocity of an inkjet print head and output a corresponding feedback signal;

a digital phase frequency detector to compare phase of the feedback signal from said velocity detector with the reference signal and output a corresponding comparison signal;

a digital loop filter to filter noise from the comparison signal; and

a motor to control velocity of the inkjet print head in response to the filtered comparison signal, wherein said phase frequency detector provides system damping by anticipating a step response of said motor, such that the amount of time that said digital loop filter changes during comparison by said digital phase detector is minimized.

30. (New) A method for controlling velocity of an inkjet print head in response to a reference signal, comprising the steps of:

detecting a velocity of an inkjet print head and outputting a corresponding feedback signal;

comparing phase of the feedback signal with phase of the reference signal using a digital phase frequency detector and outputting a corresponding comparison signal, wherein said detecting step provides damping by anticipating a step response of the inkjet print head such that the amount of time required by said comparing step is minimized;

filtering noise from the comparison signal; and

controlling velocity of the inkjet print head in response to the filtered comparison signal.

31. (New) A control system for controlling movement of a DC motor, comprising

a movement detector to detect movement of a DC motor and output a corresponding feedback signal;

a digital phase frequency detector to compare phase of the feedback signal from said movement detector with phase of a reference signal and output a comparison signal, wherein the digital phase frequency detector follows a describing function to model non-linear components; and

a digital loop filter to filter noise from the comparison signal for control of the DC motor, wherein the digital phase frequency detector has a memory with weighted states to provide for system damping, such that the amount of time that said digital loop filter changes during comparison by said digital phase frequency detector is minimized.

32. (New) A control system for controlling movement of a DC motor, comprising:

a movement detector to detect movement of a DC motor and output a corresponding feedback signal;

a digital phase detector to compare phase of the feedback signal from said movement detector with phase of a reference signal and output a comparison signal, wherein the digital phase detector follows a describing function; and

a digital loop filter to filter noise from the comparison signal for control of the DC motor.